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a. Hardystonite.

The new mineral *hardystonite* described in these Proceedings * was found in small grains in a mass of zinc ore and isolated by handpicking and the use of heavy solutions, while the (tetragonal) crystal system was determined by the study of thin sections of the grains. When visiting the mine in September, 1899, I received from the mine officials pieces from a large mass of nearly pure Hardystonite, several inches in diameter, which had been found in the same workings as the original mineral. The material is grayish-white in color, often streaked or clouded by faint pinkish tints, and breaks into angular fragments owing to the presence of several cleavages; the lustre is glassy on the more perfect cleavages, elsewhere faintly resinous. It was easy to select material for thin sections oriented parallel to the basal and prismatic cleavages and for polished plates parallel to the base, from which the indices of refraction were determined and the original statement confirmed; namely, that the mineral is tetragonal and optically negative, has a basal cleavage and primatic cleavages parallel to the prisms of the first and second orders — in addition, traces of a pyramidal cleavage were observed.

By means of the Abbé total reflectometer the indices of refraction were determined on a plate parallel to the base as follows:

* These Proceedings, XXXIV. 479, 1899.

For Na $\omega = 1.6691$ For Li $\omega = 1.6758 \pm .0002$
$\epsilon = 1.6568$ $\epsilon = 1.6647 \pm .0002$

The figures for Li are inaccurate in the fourth decimal to two or more places, owing to the indistinctness of the boundary line.

Unlike the original material, the mineral gives a strong sodium flame, and the following analysis of the new material (I) was therefore made: *

	I.	II.	III.	IV.	V.
SiO_2	37.78	37.73	624	624	38.10
Al_2O_3	0.91	0.91	8	313	0.57
Fe_2O_3	0.43	0.43	2		
ZnO	23.38	23.35	286		24.30
MnO	1.26	1.25	17		1.50
CaO	34.22	34.19	610	616	33.85
MgO	0.26	0.26	6		1.62
K_2O	0.78	0.78	8	25	....
Na_2O	1.10	1.10	17		....
Ig	0.34	....	...	...	0.52
	100.46	100.00	...	...	100.46

I. Analysis of new material.
II. Analysis of new material reduced to 100 omitting *Ig*.
III. and IV. Molecular proportions.
V. Analysis of original material.

It is seen that the alkalies replace in part the Ca and Mg, but that there is still a molecular excess of the alkalies. The thin sections show, in addition to numerous fluid inclusions, the presence of frequent small grains of an undetermined mineral to which the content in alkalies may be partly due.

* Both analysis and optical determinations were made by me in the Mineralogical Institute at Munich.

b. Zinc Schefferite.

While visiting the mine in September, 1898, my attention was called by Mr. Van Mater, Superintendent at North Mine Hill, to a peculiar pyroxene which was then coming out from the workings at the Parker Shaft, and abundant material was then secured from the ore sorting belts in the concentrating mill. The mineral occurs in large foliated masses, associated with franklinite, willemite, and small grains and masses of a white zinc mineral (to be described in the future), which often lies in thin films parallel to the basal planes of the pyroxene. The latter has a light-brownish red color in the large masses, while another variety occurring in small grains in the zinc ore has a deep brown color. The most striking physical feature is the (apparent) basal cleavage, which is as perfect as that of feldspar, in addition to the ordinary prismatic pyroxene cleavage.

The angle between the two prismatic cleavages was determined by the reflecting goniometer as 92° 59′, between the basal cleavage and the prism as 79° 02′. In a thin section parallel to (010) the angle β between the basal cleavage and c′ was determined as 74° 25′. It is readily seen in this clinopinacoidal section that the apparent cleavage parallel to the base is due to the development of gliding planes, for the basal cleavage planes enclose thin lamellae which are evidently in the position of twins parallel to the base with reference to the main mass of the mineral.

The thin sections show the usual optical character of monoclinic pyroxene, — one optic axis is approximately perpendicular to the base; on the clinapinacoid the axis of least elasticity c makes an angle of 40° 35′ with c′, lying in the obtuse angle β.

The following analysis shows that the mineral is a zinc schefferite; it was found impossible to completely decompose the mineral with HF, hence FeO was not determined.

SiO_2	52.86
$Fe_2O_3 + Al_2O_3$	1.08
MnO	5.31
ZnO	3.38
MgO	13.24
CaO	24.48
Ig	0.45
	100.80
Sp. Gr.	3.31

Optical Constants of the Schefferite.

By Dr. Gustave Melczer.

The indices of refraction were determined on polished plates, prepared by Voigt & Hochgesang, by means of the Abbé total reflectometer and with the application of the differential method proposed by Viola.* There were used (1) a plate approximately perpendicular to the acute bisectrix, (2) a thin section similarly oriented, and (3) and (4) two plates parallel to the base (001). Since the plates were not transparent, the boundaries of the total reflection could only be measured with the reducing telescope, but with this, especially in the case of the last two plates (owing to their excellent polish), the limits could be fixed within 1 to 3 minutes. By reading every 15 degrees and in the vicinity of the maxima and minima every 5 degrees (which according to my experience completely suffices with the reducing telescope), the boundary curve was constructed, and the following maxima and minima determined for Na light:

(1)	↑ 64° 26½′ and	64° 22′	62° 56′ and	62° 26′
(2)	?	?	62° 57¾′	62° 27½′
(3)	64° 25′	64° 1¼′	62° 55′	62° 23½′
(4)	64° 20¾′	64° ½′	62° 51¾′	62° 23′

The boundaries for the comparison prism were determined, after each pyroxene determination, by five readings 90° apart, as follows:

(1) 62° 11′ (2) 62° 10½′ (3) 62° 11¾′ (4) 62° 11½′

The cause of these noticeable differences in ω of the prism cannot lie in the temperature, for this only differed by 3° on the different days when the measurements were made, nor can it be due to lack of homogeneity in the glass hemisphere, for in using the enlarging telescope the mean of two readings in diametrically opposite positions of the horizontal circle were only 15 seconds apart. The cause can therefore only lie in the use of the reducing telescope itself, the accuracy of which, even with the sharpest boundaries, is only within 1 to 1½ minutes, while with the enlarging telescope the same boundaries can be determined within 10 to 15 seconds.

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* Zeit. für Kryst., XXX. 438 and XXXII. 313.

As regards the differences between the boundary angles of the individual plates, these are too large to be ascribed to indefiniteness of the boundary lines, for as already mentioned these were sharp, especially in (3) and (4). In order to be quite sure I repeated the measurements on three plates and found:

					Prism.
(1)	↑ 64° 27¾′	and 64° 23½′	→ 62° 57½′	and 62° 29′	62° 10½′
(2)	64° 21′	. . .	62° 54½′	62° 24½′	62° 12′
(3)	64° 21′	. . .	62° 51¾′	62° 21¼′	62° 11′

There the above supposition was correct.

Since the refractive index of the glass of the Abbé hemisphere, according to one of my previous determinations, is 1.8903 for Na light, and that of the glass prism used 1.6724, there follows from the boundary angles given above for the individual plates:

	γ_{na}	β_{na}	α_{na}
(1) and (2)	1.7060 ± 0.0002	1.6840 ± 0.0002	1.6766 ± 0.0004
(3)	1.7050 ± 0.0005	1.6834 ± 0.0001	1.6757 ± 0.0001
(4)	1.7045 ± 0.0001	1.6827 ± 0.0001	1.6752 ± 0.0002

and as a mean: $\gamma - \beta = 0.0218$

$\beta - \alpha = 0.0075$

$\gamma - \alpha = 0.0293$

These variations of the indices in the individual plates could perhaps be referred to local variations in the chemical composition of the zinc schefferite, or to the uneven distribution of pigment. The latter is not noticeably different, and yet it is known that for certain minerals at least very small variations produce such differences in the indices.

If from the above values we take as the mean of the indices

$$\gamma = 1.705$$
$$\beta = 1.683$$
$$\alpha = 1.676$$

then by calculation $2\,V_a$ for sodium $= 59° 29\frac{1}{4}'$.

For the direct measurement of the axial angle the plate (1) could not be used, for although one optic axis and the middle of the figure could be seen, and therefore, H_1 might have been measured, yet the geometric orientation of the surface could not be determined; the thin section (2) gave both hyperbolas, but somewhat indistinctly, so that they could only

be centred within $\frac{1}{2}°$ accuracy. The plate was immersed in monobromonapthalin whose temperature during the measurement was 19° and whose index of refraction was determined by the Abbé total-refractometer as: $n_{na} = 1.6597$. With the thin section the following values were determined in the axial angle apparatus:

	Li	Na	Tl
H_1	37° 30′	37° 20′	36° 50′
H_2	24° 10′	23° 40′	23° 40′

whence, as w_β for the section was found to be 62° 57′ 45″ and $\beta = 1.6842$:

$$2\,V_a \text{ for sodium} = 60°\ 0'\ \text{and}\ \rho > v.$$

Munich, April, 1900.